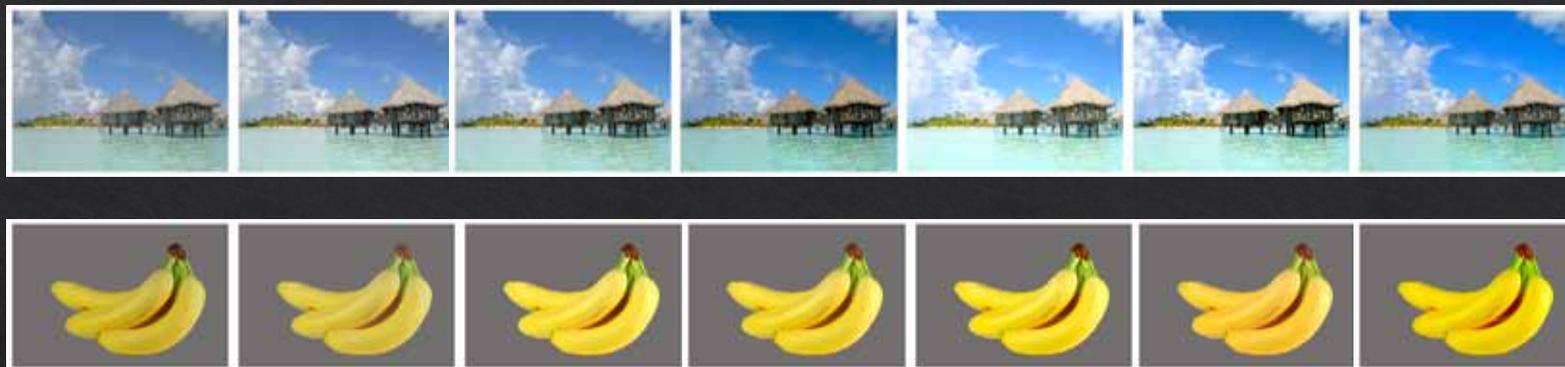# Methods for Measurement of Consistent Colour Appearance

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09. Jan. 2017

NTNU, Norway

Consistent Colour Appearance

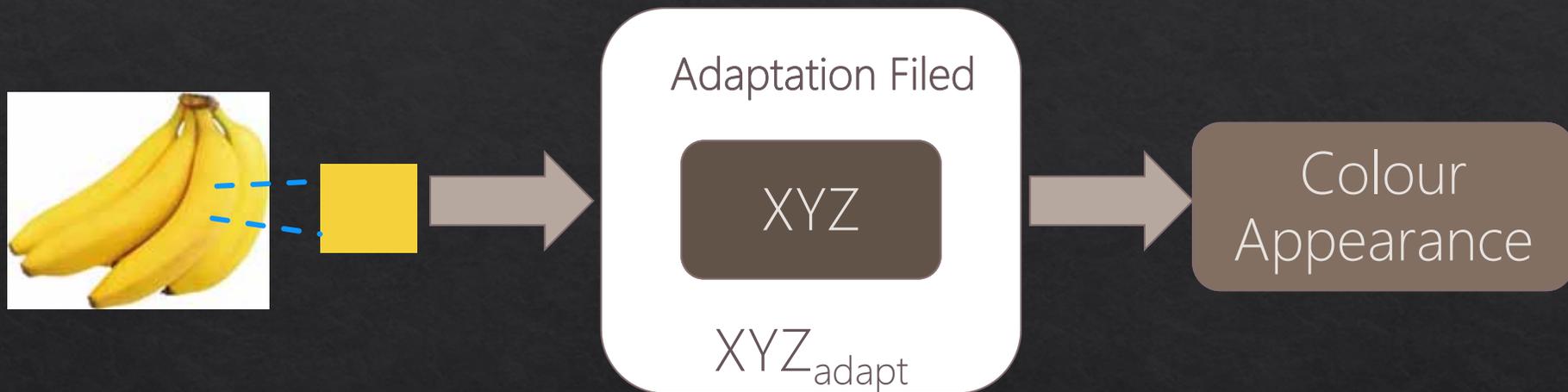Similar set   Dissimilar set

definition   statement

Consistent Colour Appearance

Adaptation Filed

XYZ

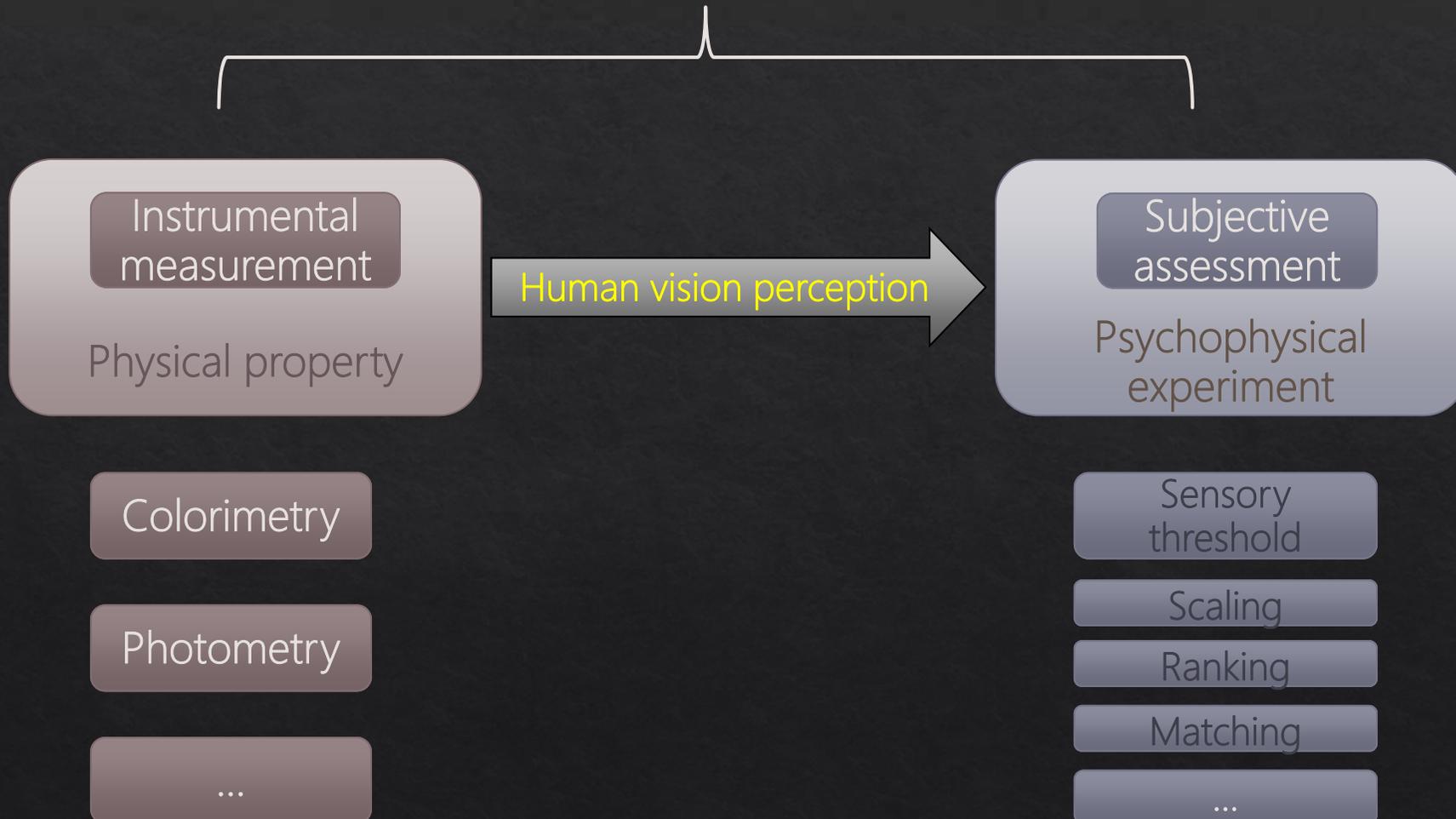XYZ_{adapt}

Colour Appearance

Colour appearance: perception in which the spectral and geometric aspects of a visual stimulus are integrated with its illuminating and viewing environment.

CIECAM02 could be a helpful for studying on CCA.
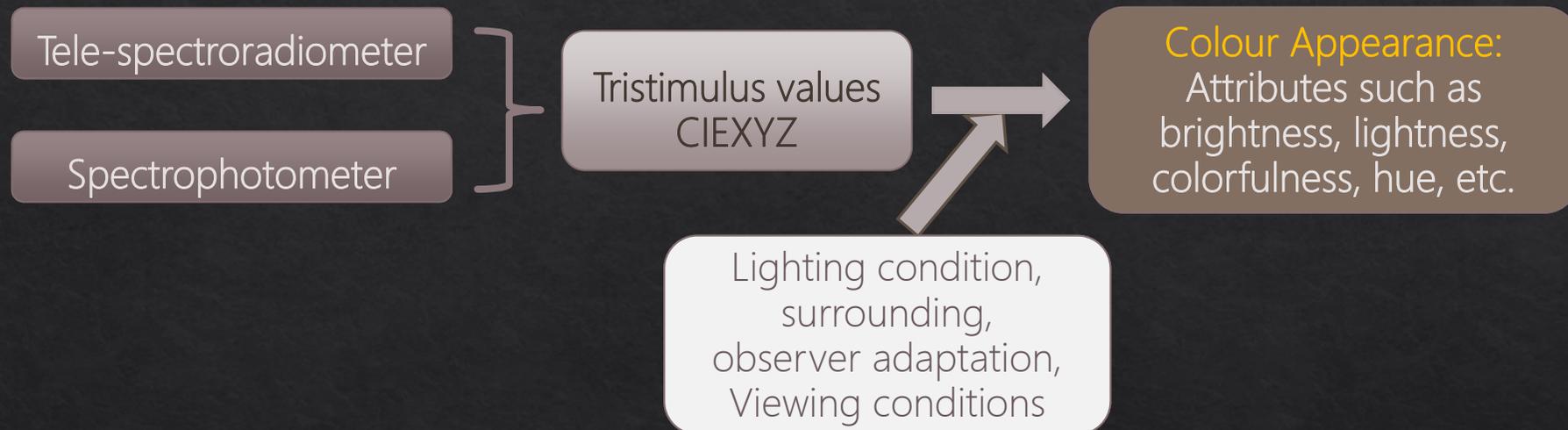
Consistent Colour Appearance

Measurement

Instrumental measurement

Physical property

Human vision perception

Subjective assessment

Psychophysical experiment

Colorimetry

Photometry

...

Sensory threshold

Scaling

Ranking

Matching

...

Consistent Colour Appearance

Instrumental Measurement and Modelling

Tele-spectroradiometer

Spectrophotometer

Tristimulus values
CIEXYZ

Colour Appearance:
Attributes such as brightness, lightness, colorfulness, hue, etc.

Lighting condition, surrounding, observer adaptation, Viewing conditions

Lighting condition lead to difference observer **adaptation**;
Viewing conditions require **multi-angle measurements**

Consistent Colour Appearance

CCA is essential for colour management on imaging, printing, textile, packaging and etc.

Product packaging Magazine advert Newspaper advert

Billboard advert Vehicle wrap Television / internet

Images from GMG slides

How to measure and evaluate CCA ? → model, metric

How to achieve CCA for high quality reproduction? → gamut mapping, tone reproduction, colour balance, device characterization, and etc.
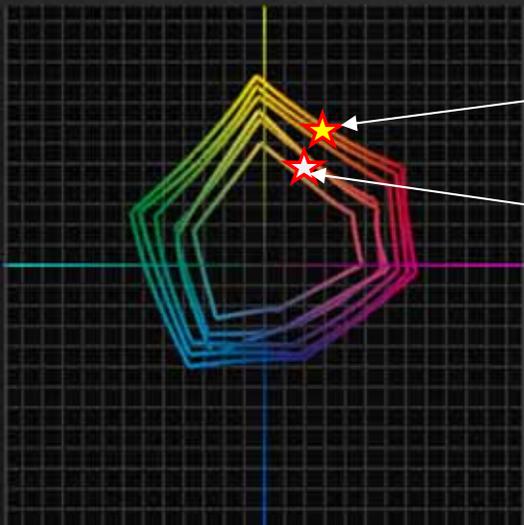
Consistent Colour Appearance

Colour gamut → Colour reproduced across media with different colour gamuts

Gamut mapping

Images from Pre-TC meeting slides

Reference colour

Available colour

Possible way: using CRPC closest to the device gamut and make a proof

Neutral or near-neutral colours → More sensitive to these colours, it may appear different from other colours

Consistent Colour Appearance

Subjective assessment

Assess colour closeness of images or prints by simultaneous comparison or ranking

Observation conditions:

Standard viewing geometry and illuminations

Varying viewing geometry and illuminations

Individual colour

Colour rendering method:

tuning by one- or multi- dimensional colour attributes, such as lightness/chromatic contrast, hue, saturation, vividness, depth, clarity, and etc.

Image assessment

assess image appearance likelihood between image sets by rendering image appearance attributes, such as contrast, saturation, noising, sharpening or gamut mapping across media

To find out colour appearance tolerance threshold, colour trend or smooth colour appearance transitions for CCA

Consistent Colour Appearance

Discussion

Is this image content – related ?

Is this hue angle – related ?

Is this device- and substrate- dependent?

Is this subject – experience related, including memory or cultures ?

Thank you
for your attention !
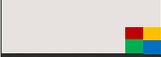
Consistent Colour Appearance

Reviews

Elena Fedorovskaya (RIT) : maintain smooth transition
consider more on visual agreement more than on colour

Jan Morovic (HP) : define a 'recipe' first and generate a set of reproductions to
understand the common factors first and then look for reliable metric

Greg High (NTNU) : viewing conditions to match real world viewing; observer
adaptation to different substrates; a measure for visual similarity; gamut
mapping constraints.

Mike Rodriguez : for a set of devices, choose closest CPRC to the device gamut
and make a proof, but pay attention to the limitations.

Yasuki Yamauchi (Yamagata University) : a new metric that measures the
difference between the test colour to an intermediate colour on the loci
of colours followed hue angles

Consistent Colour Appearance

Reviews

Standardization of assessment method

Print print gamuts

Candidate images (ISO 12640 SCID)

Printing settings for image arrangement

Image sets preparation

Fixed viewing environment ISO 3663:2000 P2

Rank sets of images on how similar, and then preferred as a set

Ask observers to creat a Champion set with best rendering for each gamut algo

CPRC definition: see ISO ***

A common colour appearance model needs to model: differences between a reference and reproduction system (substrate and context); account for different viewing modes (model known appearance effects) and predict a re-rendering and constrained gamut mapping that gives optimal colour appearance.

Elena Fedorovskaya (RIT)

We should use source or reference stimulus where each stimulus is at least two colours and should have at least three or more stimuli (reproductions) to compare against the reference. We are interested in maintaining smooth transitions between stimuli.